REMARKS

Claims 1, 2, 4, 6-10, 12, 15 and 16 were pending in this application. By the present Amendment, claim 15 has been canceled, without prejudice or disclaimer, and claims 1 and 2 have been amended to clarify the claimed subject matter. Entry of the Amendment is requested. Claims 1, 2, 4, 6-10, 12 and 16 would remain pending upon entry of this Amendment, with claims 1 and 2 being in independent form.

Claim 15 was rejected under 35 U.S.C. §112, first paragraph, as purportedly failing to comply with the written description requirement.

By the present Amendment, claim 15 has been canceled. Accordingly the issue is now moot.

Claim 1 was rejected under 35 U.S.C. §112, second paragraph, as allegedly indefinite.

By the present Amendment, claim 1 has been amended to clarify the claimed subject matter.

Withdrawal of the rejections under 35 U.S.C. §112 is respectfully requested.

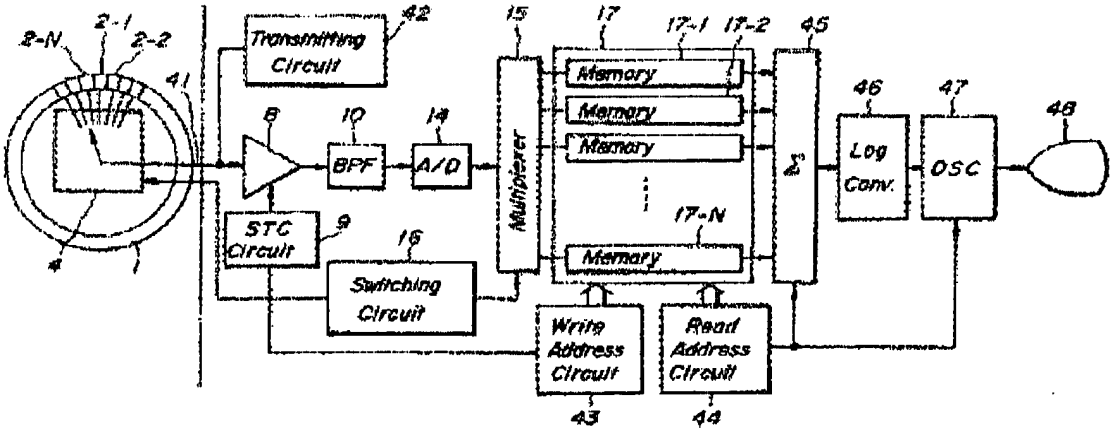
Claims 1, 2, 4, 6-10, 12, 15 and 16 were rejected under 35 U.S.C. § 103(a) as purportedly anticipated by Gondo (US 5,349,960) and further in view of Bates (US 5,787,049).

Applicant respectfully submits that the present application is allowable over the cited art, for at least the reason that the cited art does not disclose or suggest the aspects of the present application that (a) the connection change over switch is constituted in such a manner that each of the third predetermined number of the ultrasonic wave transmission and reception channels is connectable with the first predetermined number of the vibrator elements at the second predetermined number of channel intervals, and (b) a number, equal to the second or third

predetermined number, of transducer elements are used to focus ultrasonic wave beams at a time.

Gondo, as understood by applicant, proposes an ultrasonic diagnosing apparatus, as shown in Fig. 9 (reproduced below) of Gondo, wherein a vibrating element array 1 is formed by a number of vibrating elements 2-1 to 2-N arranged side by side along a circle and provided together with multiplexer 4.

FIG_9



Operation of such ultrasonic diagnosing apparatus of Gondo is discussed in Gondo, column 10, lines 34-53 (reproduced below).

> Now the operation of the present embodiment will be explained. At first, the multiplexers 4 and 15 are controlled by the switching control circuit 16 such that a first vibrating element 2-1 and first memory 17-1 are selected. Then, an impulse is generated by the transmitting circuit 42 and is supplied to the vibrating element 2-1 via the signal conductor 41 and multiplexer 4. An ultrasonic pulse is emitted from the vibrating element 2-1 toward living tissues and a reflected ultrasonic wave is received by the vibrating element 2-1. The vibrating element 2-1 converts the received ultrasonic wave into an electric echo signal or reflection signal, and the echo signal is supplied via the signal conductor 41 to the receiving amplifier 8 and is amplified thereby to a suitable signal level. The amplified echo signal is then supplied to the A/D converter 14 by means of the BPF 10 and is converted into a digital echo signal. Then, the digital echo signal is supplied via the multiplexer 15 to the memory 17-1

> and is stored therein as the wave surface data in a time sequential manner.
>
> Next, the multiplexers 4 and 15 are switched by the switching control circuit 16 such that the second vibrating element 2-2 and the second memory 17-2 are selectively connected into the circuit, and the transmission and reception of the ultrasonic pulse are carried out in the manner explained above. In this manner, a second digital echo signal is stored in the second memory 17-2. This operation is repeated until all the digital echo signals are stored in the memories 17-1 to 17-N.

Thus, the vibrating elements 2-1 to 2-N in Gondo are successively selected by the multiplexer 4, in a time division manner, and a selected vibrating element is connected to a transmitting circuit 42 and a receiving amplifier 8 and an output signal of the receiving amplifier 8 is supplied to a multiplexer 15 via band pass filter 10 and A/D converter 14. The multiplexer 15 is controlled by a switching control circuit 16 in synchronism with the multiplexer 4, so that all of the echo signals obtained by successive vibrating elements 2-1 to 2-N are stored in ***corresponding*** wave surface memories 17-1 to 17-N in a wave surface memory unit 17.

To the extent the Office Action is understood, the wave surface memories 17-1 to 17-N of Gondo are apparently equated with ultrasonic wave transmission and reception channels.

However, *N* in Gondo corresponds to the number of vibrating elements 2-1 to 2-N as well as to the number of wave surface memories 17-1 to 17-N.

Gondo does NOT disclose or suggest that the connection change over switch is constituted in such a manner that each of the third predetermined number of the ultrasonic wave transmission and reception channels is connectable with the first predetermined number of the vibrator elements at the ***second predetermined number of channel intervals***.

Indeed, in the above-mentioned ultrasonic diagnosing apparatus of Gondo, the number of vibrating elements 2-1 to 2-N as well as to the number of wave surface memories 17-1 to 17-N bear a one-to-one relationship (thereby rendering channel intervals inapplicable).

Further, Gondo says nothing whatsoever regarding using a number, equal to the second or third predetermined number, of transducer elements to focus ultrasonic wave beams at a time.

Bates, as understood by applicant, proposes an acoustic imaging system having a 1-D array that uses coded signals to achieve requisite delays.

Bates, column 1, lines 19-36 (reproduced below), was cited in the Office Action.

> Conventional acoustic wave imaging systems use a one dimensional (1-D) array of electro-acoustic transducers, for example, a 1x100 array, and have been configured to achieve linear, curved linear and sector scanning Coherence in the transmission and receipt of acoustic signals is achieved by the utilization of delay devices in the signal processing channels. Present one dimensional systems are disadvantageous due to (1) the manner in which they are constructed and (2) inherent limitations in their scanning capabilities. With respect to the manner in which they are constructed, one disadvantage is that the use of delay elements, and related electronics adds considerably to the cost of one dimensional systems, With respect to inherent limitations, one dimensional scanning systems are disadvantageous in that they only provide two dimensional images.
>
> To increase diagnostic capabilities it is desirous to have an acoustic imaging system that scans in two dimensions and thus produces a 3-D image. A problem with applying current 1-D technology to 2-D array imaging is that a vast number of electrical connections and processing electronics are required to serve an array of practical size. For example, a 100x100 array would have 10,000 individual transducers. Standard technology would require 10,000 electrical connections and processing channels. At an approximate cost of $100 per channel, such a system would require an outlay of $1M merely for channel electronics. In addition, if per channel power consumption is approximately 0.1 watt, then the system power requirement becomes at least 1 KW.

Thus, Bates points out it is advantageous to have an acoustic imaging system that scans in two dimensions and thus produces a 3-D image.

However, Bates, like Gondo, does NOT disclose or suggest the aspects of the present application that (a) the connection change over switch is constituted in such a manner that each of the third predetermined number of the ultrasonic wave transmission and reception channels is connectable with the first predetermined number of the vibrator elements at the second

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predetermined number of channel intervals, and (b) a number, equal to the second or third predetermined number, of transducer elements are used to focus ultrasonic wave beams at a time.

Such aspects enable various advantages, including, for example, that the delay times of the ultrasonic wave signals transmitted and received from the third predetermined number of ultrasonic wave transmission and reception channels can be changed regularly, and the beam can be formed rapidly.

Applicant submits that the cited art, even when considered along with common sense and common knowledge to one skilled in the art, does ***NOT*** render unpatentable the above-mentioned aspects of the present application.

Accordingly, applicant respectfully submits that independent claims 1 and 2, and the claims depending therefrom, are allowable over the cited art.

In view of the remarks hereinabove, applicant submits that the application is allowable. Accordingly, applicant earnestly solicits the allowance of the application.

If a petition for an extension of time is required to make this response timely, this paper should be considered to be such petition. The Patent Office is hereby authorized to charge any required fees, and to credit any overpayment, to our Deposit Account No. 03-3125.

If a telephone interview could advance the prosecution of this application, the Examiner is respectfully requested to call the undersigned attorney.

Respectfully submitted,

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